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NI-RE SYSTEM ALLOYS IN OXIDE CATHODES OF ELECTROVACUUM DEVICES,(U)
SEP 78 N A IOFIS, K A MATSARIN

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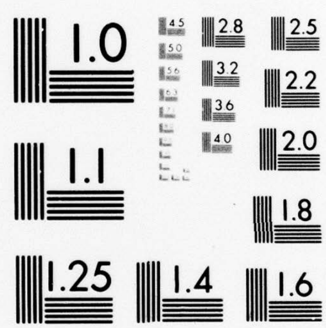

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10 By: N. A. Iofis, K. A. Matsarin, G. V. Lukoshkova, Ye. M. Savitskiy, M. A. Tylkina

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FOREIGN TECHNOLOGY DIVISION

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By

N. A. Iofis, K. A. Matsarin, et al

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М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

Ni-Re SYSTEM ALLOYS IN OXIDE CATHODES OF ELECTROVACUUM DEVICES

N. A. Iofis, K. A. Matsarin, G. V. Lukoshkova, Ye. M. Savitskiy, M. A. Tylkina, Ye. P. Arskaya

The contemporary level of automation of the individual parts of production processes and scientific equipment presents the highest requirements for operation of electrovacuum devices.

Of the number of materials used for various parts of the indicated devices, especially high requirements are presented to the alloys used as material for the cores of oxide cathodes [1].

A cathode alloy must possess sufficient mechanical strength at high temperatures (ultimate strength at 1000°C should be no less than 15-20 hG/mm^2), plasticity at room temperature, and must burn off well in a hydrogen atmosphere, since the processes of rolling, drawing of the thinnest cathode tubes (with a thickness of the walls of 30 μm and smaller), etc. are conducted in a cool state with the use of intermediate annealings in a hydrogen atmosphere.

Core material must have a high temperature of melting and low vapor pressure in comparison with nickel, which is a necessary condition for combating reverse grid currents, and also must continually render an activating influence on the process of formation of donors in the oxide layer. Here, in the space between the oxide covering and the core material, there must not form chemical compounds with high electrical resistance which could hinder the diffusion of active elements from the core to the surface of the oxide covering.

Under high-temperature conditions, the material's properties must not be changed over the entire period of use of electronic lamps. This is the main condition for preserving the constant characteristics of electrovacuum devices with high reliability and long life.

We developed NR-6VP and NR-10VP-brand alloys with a content of 6 and 10% weight of Re and K-60 and K-100-brand active alloys to serve as materials for the cores of oxide cathodes of electronic lamps with high reliability and long life. Moreover, we investigated the physical-mechanical and emission properties of these alloys [2].

The purpose of the present work is the study of alloys NR-10VP and K-100 in diodes for a service period of up to 15000 hours, and also alloy NR-10VP in real instruments for a service period of up to 6000 hours.

Testing alloys NR-10VP and K-100 in diodes

Testing of the alloys was done in diodes with cathode units of the end-type KUUK-1. The basic electrical and structural parameters of the diodes are as follows: diameter of the emitting surface 2.34 mm; distance from the cathode to the anode 0.14-0.16 mm; filament voltage 6.3 V; voltage fed to the anode - 5 V.

For comparison, we tested similar diodes with cathode cores made of alloy NIVO-3ch (Ni + 3% W).

The dependence of the anode current value on the period of service of diodes with cores of cathodes from various alloys is given in Figure 1.

Analyzing the nature of change of anode current over a long period of time, it is apparent that in diodes with cathode cores made of alloy NR-10VP the anode current monotonically grows over 9000 hours from 5.4 to 6.4 mA (i.e. by 18% from the initial value), then insignificantly falls and after 14000 hours stands at 5.0 mA.

In diodes with cathode cores made of alloy K-100, the value of anode current falls monotonically from 2000 hours; after 17,000 hours the decrease in anode current is 43% from the initial value. The anode current of diodes with cores made of alloy NIVO-3ch begins to fall at 500 hours and after 11000 hours the fall in anode current is 45% from the initial value.

Thus, better results in the value of anode current up to 5000 hours were obtained for alloy K-100, and in stability of the anode current up to 14,000 hours - for alloy NR-10VP (see Fig. 1).

Investigation of alloys NR-10VP in real instruments

Numerous studies were conducted for determining the advantages of electrovacuum instruments with cathode cores made of the new alloy NR-10VP in comparison with lamps, the cathode cores of which were made of aother alloys which are presently employed.

We conducted tests based on receiver-amplifier lamps. The results of the studies coincide with one another and show the advantages of alloy NR-10VP.

As an example, we can use the results of tests of alloy NR-10VP in receiver-amplifier-type lamps.

From the indicated alloy we made a cathode tube with a diameter of 1.27 mm with a wall thickness of 50 microns.

The parameters of the lamps were measured after the corresponding activating and aging, and also with lengthy work in the pulsed and static modes. The change in output pulsed voltage in the testing process for longevity of the lamps is given in Fig. 2. As we can see, the output pulsed voltage of lamps with cathode cores made of alloy NR-10VP over 4000 hours of work in a pulsed mode decreased by only 15%; at the same time, in lamps with cathode cores made of alloy NIVO-3B it decreased by 30% in only 1500 hours of work.

With the tests conducted in the static mode, it was shown that lamps with cathode cores made of alloy NR-10VP have greater advantages than lamps with cathode cores made of alloy NIVO-3B (Fig. 3).

The use of alloy NR-10VP in electronic lamps substantially increases the exploitation characteristics of these lamps.

Figure 1. Dependence of the anode current value (I) on the period of service of diodes with cathode cores made of alloys NR-10VP (1); K-100 (2); and NIVO-34 (3).

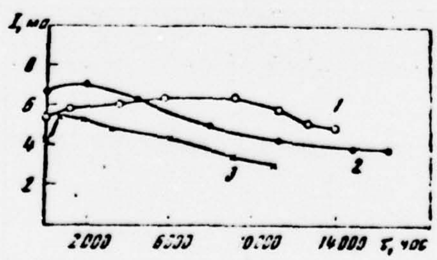

Figure 2. Change in output pulsed voltage U_{outp} in the process of testing for longevity of lamps with cathode cores made of alloys NR-10VP (1) and NIVO-3B (2).

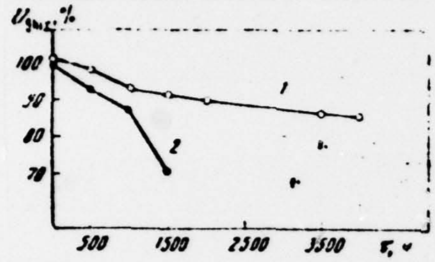

Fig. 2.

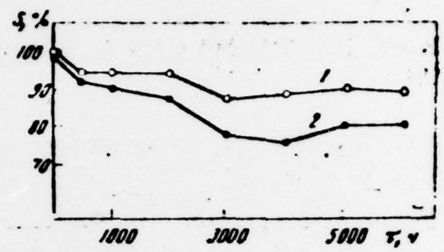

Fig. 3.

Figure 3. Change in slope I(s) in the process of testing for longevity of lamps with cathode cores made of alloys NR-10VP (1) and NIVO-3B (2).

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